

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims

Claim 1 (Currently amendment): A communication system for achieving end-to-end Quality of Service (QoS) in a mobile network ~~using terminal centric control~~, comprising:

a terminal with QoS control module that is capable of performing QoS monitoring, reporting, and enforcement; and

a central controller that accepts QoS reports from the terminal, ~~and~~ gives QoS enforcement instructions to the ~~QoS control module in the terminal~~, and performs QoS management based on the QoS records from the terminal and its subscription information; and

~~a central database that stores subscription information of a user who uses the terminal and service level agreement information~~

wherein the terminal collects QoS information from terminal's running applications, reports the collected QoS information to the central controller, receives enforcement instructions from the central controller, and regulates a behaviour of the terminal according to metrics received through a communication module.

Claim 2 (Currently amendment): The communication system according to claim 1, further comprising:

a policy control ~~framework~~ subsystem that is capable of carrying management decision to network nodes for service and QoS enforcement; and

a security control ~~framework~~ subsystem that is capable of authenticating [[the]] a user, authorizing the service and resources, and collecting accounting information based on [[the]] user's subscription information.

Claim 3 (Currently amendment): The communication system according to claim 1, comprising:

means for enforcing network QoS by exchanging information with a policy control ~~framework~~ subsystem;

means for managing QoS enforcement of the terminal based on [[the]] user's subscription information and terminal status by retrieving the user's subscription information from [[the]] a central database;

means for detecting a change of the terminal status;

means for synchronising the terminal status by updating the user's subscription information in the central database when any status change is detected; and

means for securing [[the]] message exchange with the terminal by using security association obtained from the user's subscription information.

Claim 4 (Currently amended): The communication system according to claim 1, comprising:

a local database for storing the QoS information of each terminal;

a local database for storing [[the]] tunnelling information of each terminal for QoS control and reporting purpose; and

a local database for storing status information of a network where the each terminal is attached.

Claim 5 (Previously presented): The communication system according to claim 1, comprising;

a proxy node that would securely forward messages from the terminal to the central controller in its home domain according to domain information provided by the terminal when the terminal is not directly attached to the home domain; and

a proxy node that would securely forward messages from the central controller to the terminal.

Claim 6 (Previously presented): The communication system according to claim 1, comprising:

a monitoring node in the network where the terminal is attached to that would report network information relevant to the terminal to the central controller; and

an enforcement node in the network where the terminal is attached to that would carry out enforcement command from the central controller to provide service to the terminal.

Claim 7 (Canceled)

Claim 8 (Currently amended): The communication system according to claim [[7]] 1, wherein the QoS control module in the terminal further comprises a local database for storing the collected QoS information.

Claim 9 (Currently amended): The communication system according to claim [[7]] 1, wherein [[the]] a monitor module in the QoS control module comprises:

means for capturing the QoS information and storing the QoS information at a local database in the terminal;

means for monitoring threshold violation; and

means for initiating [[the]] an enforcement module in the QoS control module to perform traffic regulation when the violation is detected.

Claim 10 (Currently amended): The communication system according to claim [[7]] 1, wherein the ~~Communication Module~~ communication module comprises:

means for packing the QoS information in a known format before sending the QoS information to the central controller;

means for parsing QoS enforcement information received from the central controller;

means for updating terminal state based on the QoS enforcement information received from the central controller; and

means for initiating [[the]] an enforcement module to perform a relevant correction in the enforcement information received from the central controller if necessary.

Claim 11 (Currently amended): The communication system according to claim [[7]] 1 wherein [[the]] an enforcement module in the QoS control module ~~further~~ comprises means for performing traffic regulation at the terminal in order to regulate terminal performance.

Claim 12 (Currently amended): The communication system according to claim ~~[[11]]~~ 10, wherein the enforcement module comprises at least any one of the following means:

- means for classifying packets into different priorities within the terminal;
- means for managing dropping of packets within the terminal when resource quota allocated to the terminal is used up;
- means for reducing congestion at the terminal by lowering a transmission rate;
- means for reducing congestion at the terminal by delaying transmission of packets when insufficient resource is allocated to the terminal;
- means for terminating sessions and stopping transmission of packets;
- means for reducing outgoing traffic by limiting total number of outgoing sessions;
- means for reducing incoming traffic by limiting total number of incoming sessions; and
- means for reducing incoming traffic by requesting for less incoming traffic.

Claim 13 (Currently amended): The communication system according to claim 1, wherein ~~[[the]]~~ a central database in the communication system stores;

- information on QoS profile of each individual user's subscription information;
- information on status of the individual terminal;
- information on service agreements between networks;
- information on status of the network providing service to the terminal; and
- information on policy handling mechanism for QoS management.

Claim 14 (Currently amended): A communication method in a communication system, wherein the communication system for achieving end-to-end Quality of Service (QoS) in a

mobile network ~~using terminal-centric control~~ comprises a terminal with QoS control module that is capable of performing QoS monitoring, reporting, and enforcement, and a central controller that accepts QoS reports from the terminal, ~~and~~ gives QoS enforcement instructions to the ~~QoS control module in the terminal, and a central database that stores subscription information of a user who uses the terminal and service level agreement information,~~ performs QoS management based on the QoS records from the terminal and its subscription information, wherein the terminal collects QoS information from terminal's running applications, reports the collected QoS information to the central controller, receives enforcement instructions from the central controller, and regulates a behaviour of the terminal according to metrics received through a communication module, the communication method comprising:

a step where the QoS control module collects service and QoS statistics, and feedbacks them to the central controller;

a step where the central controller receives QoS records from the QoS control modules;

a step where the central controller performs QoS management based on the QoS records from the terminal and its subscription information;

a step where the central controller sends QoS enforcement rules to the QoS control module for QoS adjustment; and

a step where the QoS control module performs QoS enforcement rules sent from the central controller, and also performs local enforcement decisions within itself.

Claim 15 (Currently amended): The communication method according to claim 14, comprising:

a step where the central controller updates ~~[[the]]~~ a central database about ~~[[the]]~~ terminal's status; and

a step where the central controller retrieves terminal information from the central database for QoS management.

Claim 16 (Currently amended): The communication method according to claim 14, wherein the communication system further comprises a monitoring node in the network where the terminal is attached to that would report network information relevant to the terminal to the central controller, and an enforcement node in the network where the terminal is attached to that would carry out enforcement command from the central controller to provide service to the terminal, comprising;

a step where ~~[[the]]~~ an enforcement node provides service to the terminal to collect network status information regarding the terminal and feedbacks the collected network status information to the central controller;

a step where the enforcement node provides service to the terminal to perform local admission control based on local policy;

a step where the central controller performs QoS management and decides QoS enforcement rules based on the feedback information; and

a step where the enforcement node provides service to the terminal to carry out QoS rules sent from the central controller.

Claim 17 (Original): The communication method according to claim 14, comprising:

a step where the terminal embeds QoS control capability information in a session control message and sends this information to a session control server during session initiation;

a step where the central controller initiates a monitor session when the session control server detects the QoS control capability information;

a step where the central controller replies to the terminal with a QoS control capability embedded in an acknowledgement message; and

a step where the terminal initiates the QoS control module when the acknowledgement message from the session initiation contains the QoS control capability information,

whereby communication channel between the QoS control module in the terminal and the central controller for performing QoS control is established.

Claim 18 (Original): The communication method according to claim 17, comprising:

a step where the terminal embeds QoS reporting information in a session control message and sends the information to the session control server using the established communication channel;

a step where the session control server parses the QoS reporting information embedded in the session control message; and

a step where the session control server passes the QoS reporting information to the central controller,

whereby the QoS control module reports the QoS information to the central controller.

Claim 19 (Original): The communication method according to claim 18 further comprising a step where the central controller stores the QoS reporting information at a back-end database.

Claim 20 (Original): The communication method according to claim 17, comprising:
a step where the central controller embeds QoS enforcement information in a session control message and sends it to a session client at the terminal using the communication channel;
a step where the session client parses the QoS enforcement information embedded in the session control message by session application; and
a step where the session client passes the QoS enforcement information to the QoS control module.

Claim 21 (Currently amended): The communication method according to claim 20 further comprising a step where the terminal stores the QoS enforcement information at [[the]] a terminal's local database.

Claim 22 (Currently amended): The communication method according to claim 16, comprising:
a step of computing and setting threshold and boundary values for triggering monitoring events at the terminal;
a step of triggering violation events when violation is detected at the terminal;
a step where triggering non-violation events for non-violation monitoring events at the terminal,

whereby ~~[[the]]~~ a monitoring module of the QoS control module at the terminal performs traffic monitoring.

Claim 23 (Currently amended): The communication method according to claim 14, comprising:

a step where the terminal requests for a QoS control service during ~~[[the]]~~ an access control process when the terminal attaches to a network;

a step where the central controller initiates a monitor session when an access control server informs the central controller of the QoS control service request;

a step where tunnelling channel information is allocated and embedded into ~~[[the]]~~ an access control reply by the central controller; and

a step where the tunnelling channel information is received, and the tunnelling channel is set up between the QoS control module at the terminal and the central controller using this information,

whereby communication channel between the QoS control module in the terminal and the central controller for performing QoS control is established.

Claim 24 (Original): The communication method according to claim 23, comprising:

a step of collecting the terminal's QoS information;

a step of packing the QoS information into a specified QoS report format; and

a step of sending out the QoS report to the central controller,

whereby the QoS control module reports the QoS information to the central controller.

Claim 25 (Currently amended): The communication method according to claim 24 further comprising a step of storing the collected QoS information locally at ~~[[the]]~~ a terminal's local database.

Claim 26 (Currently amended): The communication method according to claim 23, comprising:

a step where the central controller receives the QoS report from the terminal;

a step where the central controller compares the QoS report received with QoS profile obtained from ~~[[the]]~~ a back-end database;

a step where the central controller packs the QoS feedback information into a specified QoS feedback report format; and

a step where the central controller sends out the QoS feedback report to the terminal, whereby the central controller feeds back to the QoS control module in the terminal.

Claim 27 (Currently amended): The communication method according to claim 19, comprising:

a step where the central controller loads ~~[[the]]~~ a service user's QoS profile from the back-end database;

a step where the central controller loads ~~[[the]]~~ an intermediate networks QoS profile from the back-end database;

a step where the central controller obtains the status of intermediate networks from network's enforcement node;

a step where the central controller obtains the status of the terminal via reporting from communication channels;

a step where the central controller compares the state of the terminal with terminal's QoS profile; and

a step where the central controller compares the state of ~~[[the]]~~ a network node with the network QoS profile.

Claim 28 (Original): The communication method according to claim 23, comprising:

a step where the central controller decides on actions to be taken based on policy handling mechanism information stored in a back-end database;

a step where the central controller packs action information with relevant QoS parameters into an QoS enforcement message format; and

a step where the central controller sends the QoS enforcement message to the QoS control module of the terminal that needs to perform correction.

Claim 29 (Currently amended): A communication method in a communication system, wherein the communication system for achieving end-to-end Quality of Service (QoS) in a mobile network ~~using terminal-centric control~~ comprises a terminal with QoS control module that is capable of performing QoS monitoring, reporting, and enforcement, and a central controller that accepts QoS reports from the terminal and gives QoS enforcement instructions to the ~~QoS control module in the terminal, and a central database that stores subscription information of a user who uses the terminal and service level agreement information,~~ performs QoS management based on the QoS records from the terminal and its subscription information,

wherein the terminal collects QoS information from terminal's running applications, reports the collected QoS information to the central controller, receives enforcement instructions from the central controller, and regulates a behaviour of the terminal according to metrics received through a communication module, the communication method comprising:

- a step of computing a threshold value of QoS metrics that needs to be monitored;
- a step of performing local QoS adjustment to the terminal if the measurement of the QoS metrics is not within the valid range of the threshold value as computed;
- a step of collecting QoS information and usage and adjustment statistics at the terminal;
- a step of sending the QoS information in a predetermined report format to the central controller;
- a step of receiving of QoS enforcement feedback from the central controller; and
- a step of performing correction based on the feedback from the central controller.

Claim 30 (Currently amended): The communication method according to claim 29, comprising:

- a step of updating ~~[[the]]~~ a terminal's local database with the QoS data collected; and
- a step of updating the terminal's local database with the enforcement feedback received from the central controller.

Claim 31 (Original): The communication method according to claim 29 wherein packet transmission at terminal is delayed for the local QoS adjustments to the terminal.

Claim 32 (Original): The communication method according to claim 29 wherein packet is dropped at the terminal for the local QoS adjustments to the terminal.

Claim 33 (Original): The communication method according to claim 29 wherein packet transmission rate is reduced at the terminal for the local QoS adjustments to the terminal.

Claim 34 (Original): The communication method according to claim 29 wherein request for receiving channels is reduced at terminal for the local QoS adjustments to the terminal.

Claim 35 (Original): The communication method according to claim 29 wherein transmission/receiving session initiated by the terminal is gracefully self-terminated for the local QoS adjustments to the terminal.

Claim 36 (Currently amended): The communication method according to claim 14, wherein a data format for reporting information from the terminal to the central controller includes:

message ID to distinguish [[the]] different incoming messages;

message length to indicate length of the entire message for reporting status; and

QoS reporting data including attribute value pair that contain [[the]] a QoS type and its value.

Claim 37 (Currently amended): The communication method according to claim 14, wherein a data format for QoS enforcement information from the terminal to the central controller includes:

message ID to distinguish [[the]] different incoming messages;

action ID to indicate [[the]] an action to be carried out; and

QoS enforcement data that contains parameters associated with the action ID.

Claim 38 (Currently amended): The communication method according to claim 37, comprising:

a step of checking the action ID referring a pre-defined template; and

a step of packing or unpacking the QoS enforcement data according to [[the]] a pre-defined template,

whereby the action ID of the QoS enforcement data is encoded and/or decoded.

Claim 39 (Currently amended): The communication method according to claim 25, comprising:

a step where the central controller loads [[the]] a service user's QoS profile from [[the]] a back-end database;

a step where the central controller loads [[the]] an intermediate networks QoS profile from the back-end database;

a step where the central controller obtains the status of intermediate networks from network's enforcement node;

a step where the central controller obtains the status of the terminal via reporting from communication channels;

a step where the central controller compares the state of the terminal with terminal's QoS profile; and

a step where the central controller compares the state of [[the]] a network node with the network QoS profile.